

The effect of the reflected phase on the performance of EBG structures used as substrate for planar antennas

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In this paper the relation between the reflected phase under planewave normal incidence of several three-dimensional EBG structure and the input impedance of a dipole antenna placed on top of them is explored.

The EBG structures that have been studied are the silicon and Zirconium Tin Titanate layer-by-layer or woodpile structure [1,2] and the Fan's structure [3]. In all cases the input impedance of a dipole placed on top of them at different positions and orientations has been computed. The input impedance has been found to be very dependent on the orientation of the dipole with respect to the EBG surface. For parallel orientations, i.e. dipole parallel to the features of the EBG surface, the input impedance of the dipoles is very low. Conversely, for the "perpendicular" configurations the dipoles present higher input impedance, closer to the characteristic impedance of a coplanar stripline.

This result has been found to be directly linked to the phase of the reflected wave under normal incidence. For parallel polarisation incidence, the phase is close to 180 deg, what agrees with the low input impedance of these configurations, since the dipoles can be seen as if they were short-circuited. Conversely, for the perpendicular incidence the reflected phase is closer to 0 deg. These results have been confirmed by simulation and measurements.

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[3] S. Fan, P.R. Villeneuve, R.D. Meade and J. D. Joannopoulos, Appl. Phys. Lett., **65**, 11 (1994).